[0098] The distillation process using microchannel distillation assemblies **100**, **100**A, **100**B, **100**C, **100**D and **100**E illustrated in **FIG. 9** is similar to the distillation process illustrated in **FIG. 1** with the exception that the distillation process illustrated in **FIG. 9** is suitable for treating a fluid mixture containing more than three components, for example, six components. The microchannel distillation assemblies **100**-**100**E employ microchannel distillation columns or apparatuses **110***a*, **110***b*, **110***c*, **110***d* and **110***e*, respectively. Microchannel distillation assemblies **100**-**100**E have the same construction and may be operated in the same manner as the microchannel distillation assembly **100** illustrated in **FIG. 1**, although in each of the assemblies **100**-**100**E different feed streams may be treated and the operating temperatures may be different. Additional feed streams, such as feed stream F2, can be used with one or more of the microchannel distillation assemblies **100**-**100**E. Some of the streams, for example, bottoms product B2 and distillate product D2', may be combined. The final products produced in the process illustrated in **FIG. 9** are distillate products D3, D3' and D3", and bottoms products B3, B3' and B3". Intermediate distillate products D1, D2 and D2', and intermediate bottoms products B1, B2 and B2' are also produced. The microchannel distillation assemblies **100**-**100**E can be housed separately or combined in a single construction or apparatus (e.g., within a single block or vessel). Although six microchannel distillation assemblies **100**-**100**E are depicted in **FIG. 9**, any number of microchannel distillation assemblies can be used, for example, tens, hundreds, etc. An advantage of combining the microchannel distillation assemblies in a single construction is that heat exchange economies can be achieved wherein, for example, a relatively cold part of one microchannel distillation assembly may cool a relatively hot part of another microchannel distillation assembly.

[0099] The distillation process, using microchannel distillation assemblies **200**, **200**A, **200**B, **200**C, **200**D and **200**E illustrated in **FIG. 11**, is similar to the distillation process illustrated in **FIG. 2** with the exception that the distillation process illustrated in **FIG. 11** is suitable for treating a fluid mixture containing more than three components, for example, six components. The features of the microchannel distillation assemblies **200**A-**200**E that are the same as those for the microchannel distillation assembly **200** are identified with the same reference numeral except the numeral is followed by the letter A, B, C, D or E. The microchannel distillation assemblies **200**A-**200**E may be operated in the same manner as the microchannel distillation assembly **200** as described above, although in each of the assemblies **200**A-**200**E different feed streams may be treated and the operating temperatures may be different. Some of the streams, for example, bottoms product B^{21} and distillate product D^{22}, may be combined. The final products produced in the process illustrated in **FIG. 11** are distillate products D^{31}, D^{32} and D^{33}, and bottoms products B^{31}, B^{32} and B^{33}. Intermediate distillate products D^{1}, D^{21} and D^{22}, and intermediate bottoms products B^{1}, B^{21} and B^{22} are also produced.

[0100] In an alternate embodiment to the embodiments depicted in **FIGS. 8 and 11**, the microchannel distillation columns or apparatuses **210** and **210**A (**FIG. 8**) or the microchannel distillation columns or apparatuses **210**, **210**A, **210**B, **210**C, **210**D and **210**E (**FIG. 11**) can be combined in a single operation wherein they are connected in series or parallel to provide for multiple separations. These can be housed separately as shown in **FIGS. 8 and 11** or they can be combined in a single construction (e.g., within a single block or vessel). Although two microchannel distillation columns or apparatuses (**210** and **210**A) are depicted in **FIG. 8** and six microchannel distillation columns or apparatuses (**210**, **210**A, **210**B, **210**C, **210**D and **210**E) are depicted in **FIG. 11**, this can be done with any number of microchannel distillation units, for example, tens, hundreds, etc. An advantage of combining the microchannel distillation columns or apparatuses in a single construction is that heat exchange economies can be achieved wherein, for example, a relatively cold part of one microchannel distillation unit may cool a relatively hot part of another microchannel distillation unit.

[0101] The microchannel distillation assembly **300** illustrated in **FIG. 10** contains a plurality of adjacent microchannel distillation columns or apparatuses **310** arranged in parallel spaced rows **313**. The rows **313** of microchannel distillation columns or apparatuses **310** are separated by cross-flow heat exchange channels **340** positioned between the rows **313**. Heat exchange manifolds **342** and **344** distribute heat exchange fluid to the heat exchange channels **340**. The heat exchange manifold **342** includes heat exchange fluid inlets **343**. Heat exchange manifold **344** includes heat exchange fluid outlets **345**. This embodiment provides the advantage of avoiding the use of interleaved heat exchange channels while still providing the required temperature profile. In this embodiment each heat exchange channel is in thermal communication with a plurality of microchannel distillation columns or apparatuses **310**. The microchannel distillation assembly **300** employs a separate heat exchange manifold for each layer of heat exchange channels. Alternatively, a common manifold for a plurality of or all of the heat exchange channels can be used.

[0102] The microchannel distillation columns or apparatuses **110**, **210** or **310** may be connected together with a macromanifold pipe connection that allows a single feed inlet to supply feed to each of the individual microchannel distillation columns or apparatuses. Macromanifold connections of a large pipe, not necessarily circular, may also gather products or effluent from the plurality of microchannel distillation columns or apparatuses. The microchannel distillation columns or apparatuses may be operated in parallel or alternatively in series. The series microchannel distillation columns or apparatuses may be advantageous in order to break up the total number of microchannel distillation sections or stages that are required by dividing each microchannel distillation columns or apparatuses into two or more microchannel distillation columns or apparatuses.

[0103] In addition to the distillation processes illustrated in **FIGS. 1-12**, there are other distillation processes that may be used for separating fluids for which the inventive microchannel distillation process may be employed. For example, distillation processes with any number of microchannel distillation columns or apparatuses, for example, ten, twenty, thirty, etc., can be employed similarly to those illustrated. Distillation processes that can be conducted in accordance with the invention include: processes employing partitioned columns; topping and tailing processes or tailing and topping processes, which may employ two distillation columns; easiest separation first processes, which may employ three distillation columns; and full thermal coupling processes which employ two distillation columns. These distillation